

Management of the potato cyst nematodes, *Globodera* spp. through plant rhizosphere bacterium *Pseudomonas fluorescens* Migula

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ABSTRACT: Application of a formulation of *Pseudomonas fluorescens* Migula (Pf) in talc containing 15×10^8 colony forming units per g @ 10 and 20 kg per ha and carbofuran @ one kg a. i. /ha reduced potato cyst nematode parasitization of potato roots by 47.7, 62.6 and 81.3 per cent, respectively. Earlier root entry of nematodes was observed in control and Pf treatments. The nematodes in these treatments were in the fourth juvenile or adult stage while they were in the second or third-stage under carbofuran. Potato tuber yield was higher by 29.4, 39.4 and 77.8 per cent under Pf @ 10 kg / ha, Pf @ 20 kg / ha and carbofuran @ one kg a. i. / ha, respectively.

KEY WORDS: *Globodera* spp., potato cyst nematodes, *Pseudomonas fluorescens*

Area under potato cultivation in the hills of the Nilgiris and Kodaikanal in Tamil Nadu (TN) has come down considerably in recent years owing to the devastation caused by the potato cyst nematodes (PCN), *Globodera* spp. (Krishna Prasad, 1992). Alternate method to the application of carbofuran 3G for the control of PCN is felt necessary because of higher cost of the chemical, development of resistance to nematicide and environmental pollution. *Pseudomonas fluorescens* Migula, a

potential nematode biocontrol agent (Shanthi and Sivakumar, 1995) which is available as a commercial formulation in Tamil Nadu Agricultural University, Coimbatore; was evaluated in this study for the management of the potato cyst nematodes on potato in the Nilgiris, under field conditions.

MATERIALS AND METHODS

The trials were conducted in a loamy soil with a pH 5.5 at the Horticultural

Research Station, Tamil Nadu Agricultural University, Udthagamandalam. Both the field experiments were identical in all respects. Four treatments namely *P. fluorescens* @ 10 kg per ha, *P. fluorescens* @ 20 kg per ha, carbofuran 3G @ one kg a. i. / ha and control (untreated) were evaluated in a randomized blocks design. Each treatment was replicated six times. Each replicate consisted of a plot of 5 x 2m size, separated by 0.75m inter-space with 50cm wide bunds. Six comprehensive soil samples of 250g each, representing each replicate, were prepared from pooled samples collected from all plots belonging to each set of replicates. The soil samples were shade dried and processed by floatation in one litre conical flask (Southey, 1986) and the number of viable cysts counted. The egg contents of the viable cysts were determined by crusting 25 cysts selected at random (Brown, 1969), and the pre-planting egg population was counted and expressed as number per g soil. *Pseudomonas fluorescens* formulated in talc (Vidhyasekaran *et al.*, 1996) to give a density of 15×10^8 colony forming units (cfu)/g was used 15 days after preparation. The treatments were given at the time of planting in rows 50cm apart. Seed potatoes of cultivar Kufri-Jyothi were planted at an interval of 30cm. Both the crops were raised under rainfed conditions from September, 1997 to January, 1998; in two different locations. The cyst nematode population in roots was determined from five plants pulled off at random 45 days after planting (DAP).

The extent of root colonization by the biocontrol agent (Pf) at 45 DAP was also

determined from these samples. The roots were stained with acid fuschin-lactophenol and the nematodes were counted.

At the termination of the experiment, soil samples were collected from each replicate, processed and the egg-population per g soil was estimated as per the procedure described earlier and the tuber yield recorded.

RESULTS AND DISCUSSION

The results indicated that all the treatments involving either the rhizobacterium *P. fluorescens*, or carbofuran suppressed nematode build up in the roots and soil (Table 1).

Observations taken 45 DAP showed that carbofuran reduced nematode penetration into the roots to a maximum extent of 81.3 per cent, which was followed by 62.6 and 49.7 per cent by Pf @ 20 kg / ha and 10 kg / ha, respectively. All the treatments significantly reduced number of juveniles in the roots when compared with the untreated control. In Pf treated and control plants, the nematodes had reached the fourth juvenile or the adult stage, while in carbofuran treatment they were only in the second or third juvenile stage.

At the termination of the experiments, the treatments with carbofuran, as well as with Pf showed an increase in the number of cysts with eggs but to a significantly lesser extent when compared with the untreated control. The increase in the number of viable cysts in the soil was 212.7, 106.3, 79.4 and 36.5 per cent in the

Table 1. Field evaluation of *P. fluorescens* against *Globodera* spp. in potato

Treatment	Population at planting (in soil)	Population at 45DAP (in root)			Final population		Yield/ha (Mt)	Yield increase over control (%)
	Cysts/100g	Eggs/g	Larvac/g	Pf-Cfu/g	Cysts/100gs	Eggs/g		
Pf @ 10kg/ha	63.0±6	38.0±8	78.0a	70 x 108	130.0a	131.0	14.88a	29.9
Pf @ 20 kg/ha	63.0±6	38.0±8	58.0b	89 x 108	113.0a	126.0	16.06a	39.4
Carbofuran 3G @ 1 kg a. i./ha	63.0±6	38.0±8	29.0c	-	86.0b	87.0	20.48b	77.8
Control (Untreated)	63.0±6	38.0±8	155.0d	-	197.0c	198.0	11.52c	
CD (P=0.05)			17.59		20.16		2.91	

untreated, Pf 10 kg / kg, Pf 20 kg / ha and carbofuran one kg a. i. / ha, respectively. The biocontrol agent at 10 kg as well as at 20 kg / ha and carbofuran one kg a. i. / ha increased the yield significantly over control, but there was no significant difference in yield between the two dosages of the biocontrol agent. The increase in yield was 77.8 per cent for carbofuran one kg a. i. / ha, 29.9 per cent under Pf 10 kg per ha and 39.4 per cent under Pf 20 kg / ha (Table 1). Root colonization by Pf was observed in both the dosages tried at 45 DAP.

The experiments showed that even though Pf suppressed invasion of roots by the nematodes, it permitted their entry at an earlier stage of the crop, probably before the bacterium fully colonized the roots. The strain of Pf used in the experiment is a good antagonist of potato cyst nematode and has the ability to establish in acid organic soils. In spite of the phenomenal increase in yield under carbofuran, application of Pf at 10 kg/ha proved to be more economical costing Rs.450/ha, and fetching an additional income of Rs.13,440/ha.

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